#19

1-9-4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): Reinhard Klemm
Case: 2
Serial No.: 09/164,509
Filing Date: September 30, 1998
Group: 2141
Examiner: Stephan F. Willett

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

Signature: [signature] Date: December 23, 2003

Title: Method and Apparatus for Prefetching Internet Resources Based on Estimated Round Trip Time

---

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants hereby appeal the final rejection dated July 30, 2003, of claims 1 through 29 of the above-identified patent application.

REAL PARTY IN INTEREST

The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded on September 30, 1998 in the United States Patent and Trademark Office at Reel 9491, Frame 0209. The assignee, Lucent Technologies Inc., is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

Claims 1 through 29 are pending in the above-identified patent application. Claims 1 through 26 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Horvitz et al. (United States Patent Number 6,067,565) in view of Bryant et al. (United States Patent Number 6,078,956). Claims 1 through 29 also remain rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. (United States Patent Number 5,961,603) in view of Narayanaswami (United States Patent Number 6,182,113) and Bryant et al. and claims 1 through 29 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. in view of Vaid et al. (United States Patent Number 6,119,235) and Bryant et al.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF INVENTION

The present invention is directed to methods and apparatus for prefetching Internet resources based on the estimated round trip time for the resources referenced in a currently displayed Web page. (Page 4, line 27, to page 5, line 16.) Documents with the longest access times are prefetched first and prefetching generally continues until the estimated round trip time falls below a predefined threshold. Thus, if a user clicks on an embedded hyperlink, the referenced document has either been fetched already or, if not, fetching the document from the origin server takes only a short time. (Page 3, lines 6-10.)

The "round trip" time or access time of a resource is the time interval between the sending of the first byte of an HTTP request for the resource until the last byte of the server response has arrived at the requesting Web client. The round trip time may be estimated in accordance with the present invention, for example, using an HTTP HEAD request. (Page 5, line 18, to page 6, line 11.) A HEAD request obtains status information and the size of the requested resource, s, from the origin server. If the server responds to the HEAD request with the document size, s, the prefetching agent computes the estimated round trip time for further processing. (Page 9, line 25, to Page 10, line 13.) If the server responds but fails to specify the document size, the prefetching agent utilizes the recorded average resource size, s, of resources previously received from the server. If the HEAD

request does not yield any response from the server, or if the response shows an error code, then the prefetching agent determines that the hyperlinked document is not accessible and can provide an error message immediately once the user clicks on this hyperlink.

ISSUES PRESENTED FOR REVIEW

i. Whether claims 1 through 26 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Horvitz et al. in view of Bryant et al.;

ii. Whether claims 1 through 29 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. in view of Narayanaswami and Bryant et al.; and

iii. Whether claims 1 through 29 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Kunkel et al. in view of Vaid et al. and Bryant et al.

GROUPING OF CLAIMS

The rejected claims stand and fall together.

ARGUMENT

Independent claims 1, 17, and 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Horvitz et al. in view of Bryant et al.

The Examiner has asserted that Horvitz teaches prefetching Internet resources dependent on round-trip times based on send and receive times (col. 24, lines 12-20).

Applicant notes that Horvitz teaches that prefetching is performed according to an ascending order of prefetch times, i.e., an ascending order of the time required to prefetch an Internet resource. Independent claims 1, 25, and 27-29 require prefetching Internet resources according to a descending order of round trip times.

The Examiner further asserts that "various orders and round-trip times are taught and language identical or verbatim is not required in an obvious rejection."

Applicant maintains that the order of fetching is critical to the performance of prefetching Internet resources. Thus, contrary to the Examiner's assertion, the order of prefetching should be considered in an obvious rejection. In particular, Horvitz actually teaches away from the

present invention by teaching to prefetch in ascending order of prefetch times. Thus, a person of ordinary skill in the art would not read Horvitz to suggest prefetching in descending order of prefetch times, as is required by the independent claims of the present invention.

Thus, Horvitz does not disclose or suggest prefetching Internet resources according to a descending order of prefetch times, as required by independent claims 1, 17, 25, and 27-29. In fact, if anything, Horvitz actually teaches away from the present invention.

Kunkel et al. in view of Vaid et al. and Bryant et al.

The Examiner also asserts that Kunkel discloses the prefetching of Internet resources. The Examiner recognizes, however, the Kunkel does not disclose or suggest the prefetching of data based on a descending order of round trip times and data size.

The Examiner further asserts that Vaid teaches a system to schedule downloading of data in order to provide optimized computer usage. In addition, the Examiner notes that Vaid teaches "estimating a bit rate over a round-trip time between the data source and the data receiver." citing Abstract.

While Vaid may disclose the estimation of round-trip times of data exchanged between a sender and a receiver in a data network, Vaid estimates the round-trip times of TCP/IP packets. The present invention, on the other hand, estimates the round-trip times of HTTP request/response events.

HTTP traffic travels through software that runs atop TCP/IP stacks on client, server, and proxy computers. HTTP traffic therefore incurs latencies caused by such software. These latencies are generally not reflected in the TCP/IP round-trip times computed by Vaid. Moreover, HTTP traffic for the purpose of Web document prefetching, as in the context of the present invention, shows characteristics in terms of length and origin server access frequency that general TCP/IP traffic does not exhibit (the origin server is referred to as the "receiver" in Vaid). The present invention takes advantage of such HTTP traffic characteristics in its round-trip time estimation.

For example, the present invention considers the length of an HTTP response (e.g., via an HTTP HEAD request) and the actually measured round-trip times of previous HTTP requests to the same origin server when computing the estimated round-trip time of an HTTP request/response event. Thus, the round-trip time estimations of the present invention are

dynamically adjusted, based on changing network and server conditions, because estimates are based on previously measured round-trip times of HTTP request/response events to the same origin server. The adaptation to changing actual round-trip times is effected by a linear weighing function that uses previous HTTP request/response events, if available, to the same origin server as data points. If there was no previous HTTP request/response event to the same origin server in the past, a baseline estimate is established through actually fetching a document from the origin server via an HTTP GET request rather than estimating the round-trip time of the document. Vaid uses an unspecified baseline estimate in all cases.

Thus, Kunkel et al.or Vaid et al., alone or in combination, do not disclose or suggest prefetching one or more Internet resources based on a descending order of estimated round trip times that is "based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request," as required by each of the independent claims.

An example helps to illustrate the fundamental differences between Vaid and the present invention. Assume that a user, A, is communicating with two servers, B and C. The time interval between A sending a TCP packet to B and receiving back an acknowledgement is 100 msec. The time interval between A sending a TCP packet to C and receiving back an acknowledgement is 200 msec. Further assume that identical Web servers are added to both B and C and that B has a slower processor than C. An HTTP request for a resource, R, processed by the Web server on machine B takes 400 msec, whereas processing an HTTP request for a resource, R', by the Web server on C takes 100 ms. It is assumed that the HTTP requests for R and R' and the HTTP responses to R and R' all fit in one TCP/IP packet each, a quite typical scenario.

Thus, the estimated round trip time for sending the HTTP request for resource, R, from machine A to B (100 msec), processing the request in B's HTTP server (400 msec), and sending the HTTP response back to A (100 msec) is a total of 600 msec. The estimated round trip time for sending the HTTP request for resource, R', from machine A to C (200 msec), having C's HTTP server process the request (100 msec) and sending the response back to A (200 msec) is a total of 500 msec.

Thus, based on the TCP round trip time computed by Vaid, the resource from server C (with the longer TCP time) would be prefetched first. Based on the estimated round trip time computed by the present invention, however, the resource from server B (with the longer estimated

HTTP round trip time) would be prefetched first. Thus, applying the present invention to this example yields exactly the opposite result that would be achieved using the round trip time of Vaid. However, Applicant asserts that this inventive method results in a more responsive and enjoyable user experience with reduced latencies in obtaining requested Web resources.

Additional Cited References

Narayanaswami was also cited by the Examiner for its disclosure that present Web pages are resolved periodically so as to maintain a list of currently active links based on one or more variables.

Narayanaswami is directed to the dynamic multiplexing of hyperlinks and bookmarks. Narayanaswami do not address the issue of prefetching based on prefetch times.

Thus, Narayanaswami does not disclose or suggest prefetching Internet resources according to a descending order of prefetch times, as required by independent claims 1, 17, 25, and 27-29.

Bryant et al. were also cited by the Examiner for its disclosure of measure response times as seen by an end user for requests submitted from a Web browser to a Web server.

Bryant is directed to "a method of logging information in a computer network having a Web client connectable to a Web server. In response to the HTTP request,(and as a result of receiving a response to that request), a response time associated with that first HTTP request is calculated. Thereafter, the response time calculated is passed from the Web client on a subsequent HTTP request to that Web server, where the information is logged for later use." Citing Abstract.

Thus, Bryant et al. do not disclose or suggest prefetching Internet resources according to a descending order of prefetch times, as required by independent claims 1, 17, 25, and 27-29.

Conclusion

Thus, Horvitz et al., Bryant et al., Kunkel et al., Narayanaswami, or Vaid et al., alone or in combination, do not disclose or suggest prefetching one or more Internet resources based on a descending order of estimated round trip times that is "based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request," as required by each of the independent claims.

The rejections of the independent claims under section §103 in view of Horvitz et al., Bryant et al., Kunkel et al., Narayanaswami, and Vaid et al., alone or in any combination, are therefore believed to be improper and should be withdrawn.

The remaining rejected dependent claims are believed allowable for at least the reasons identified above with respect to the independent claims.

The attention of the Examiner and the Appeal Board to this matter is appreciated.

Respectfully,

Kevin M. Mason

Date: December 23, 2003

Kevin M. Mason
Attorney for Applicant(s)
Reg. No. 36,597
Ryan, Mason & Lewis, LLP
1300 Post Road, Suite 205
Fairfield, CT 06824
(203) 255-6560

APPENDIX

1. A method of prefetching one or more Internet resources referenced in one or more Web pages, said method comprising the steps of:

obtaining one or more estimated round trip times for said Internet resources, wherein said one or more estimated round trip times are based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request; and

prefetching said Internet resources based on a descending order of said one or more estimated round trip times.

2. The method according to claim 1, wherein two or more of said Internet resources are prefetched substantially in parallel.

3. The method according to claim 1, wherein said step of prefetching said Internet resources based on said one or more estimated round trip times is performed only for Internet resources associated with origin servers that have been previously accessed and said method further comprising the step of prefetching all Internet resources associated with servers that have not been previously accessed.

4. The method according to claim 1, wherein said one or more estimated round trip times for each Internet resource is based on average access time statistics for the corresponding origin server and the actual size of said Internet resource when said actual size is available.

5. The method according to claim 4, wherein said one or more estimated round trip times for each Internet resource is based on average access time statistics for the corresponding origin server and the average size of Internet resources provided by said origin server if said origin server does not indicate said actual size.

6. The method according to claim 4, wherein said one or more estimated round trip times for each Internet resource is based on average access time statistics for the corresponding

origin server and the average size of Internet resources provided by said origin server if the setup and wait time for accessing said origin server is not significantly less than the average round trip time for Internet resources obtained from said origin server.

7. The method according to claim 1, wherein said one or more estimated round trip times are based on at least one actual prior round trip time for said Internet resource.

8. The method according to claim 1, wherein said step of prefetching said Internet resources does not begin until said one or more Web pages have been fetched.

9. The method according to claim 1, wherein said step of prefetching said Internet resources continues until said Internet resources have been prefetched or until a user selects a new Web page.

10. The method according to claim 1, further comprising the steps of storing said Internet resources in a cache and determining if any of said Internet resources are already stored in said cache before prefetching begins.

11. The method according to claim 1, further comprising the step of applying a filter to said Internet resources to reduce the overhead on network, server or local resources due to prefetching.

12. The method according to claim 11, wherein said filter discards all Internet resources that do not use the HTTP protocol for transmission.

13. The method according to claim 11, wherein said filter discards all Internet resources that corresponding to dynamically generated Web resources.

14. The method according to claim 11, wherein said filter discards all Internet resources that correspond to resources whose size is more than a certain maximum size threshold.

15. The method according to claim 11, wherein said filter discards all Internet resources that correspond to resources whose estimated round trip time is longer than a certain maximum time.

16. The method according to claim 11, wherein said filter discards all Internet resources that correspond to resources whose estimated round trip time is shorter than a certain minimum time threshold.

17. A method of prefetching one or more Internet resources referenced in one or more Web pages, said method comprising the steps of:

determining one or more estimated round trip times for said Internet resources based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request;

sorting a list of said Internet resources based on a descending order of said one or more estimated round trip times;

prefetching said sorted list of Internet resources until one or more predefined threshold conditions are met.

18. The method according to claim 17, wherein two or more of said Internet resources are prefetched substantially in parallel.

19. The method according to claim 17, wherein said step of prefetching said Internet resources based on said descending order of said one or more estimated round trip times is performed only for resources associated with origin servers that have been previously accessed and said method further comprising the step of prefetching all resources associated with servers that have not been previously accessed.

20. The method according to claim 17, wherein said one or more estimated round trip times for each Internet resource is based on average access time statistics for the corresponding

origin server and the actual size of said Internet resource when said actual size is available.

21. The method according to claim 20, wherein said one or more estimated round trip times for each Internet resource is based on average access time statistics for the corresponding origin server and the average size of Internet resources provided by said origin server if said origin server does not indicate said actual size.

22. The method according to claim 20, wherein said one or more estimated round trip times for each Internet resource is based on average access time statistics for the corresponding origin server and the average size of Internet resources provided by said origin server if the setup and wait time for accessing said origin server is not significantly less than the average round trip time for Internet resources obtained from said origin server.

23. The method according to claim 20, further comprising the step of applying a filter to said Interent resources to reduce the overhead on network, server or local resources due to prefetching.

24. The method according to claim 23, wherein said filter discards all Internet resources selected from the set comprised substantially of those Internet resources that (i) do not use the HTTP protocol for transmission; (ii) correspond to dynamically generated Web resources; (iii) correspond to resources whose size is more than a certain maximum size threshold, (iv) correspond to resources whose estimated round trip time is longer than a certain maximum time, or (v) correspond to resources whose estimated round trip time is shorter than a certain minimum time threshold.

25. A system for prefetching one or more Internet resources referenced in one or more Web pages, each of said Internet resources having an associated origin server, said tool comprising:

a memory for storing a server statistics database that records access time statistics for each origin server that has been previously accessed;

a processor operatively coupled to said memory, said processor configured to:

obtain one or more estimated round trip times for said Internet resources, wherein said one or more estimated round trip times are based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request; and

prefetch said Internet resources based on a descending order of said one or more estimated round trip times.

26. The system according to claim 25, wherein said server statistics database records the average setup, wait and byte transmission times and average resource size for said Internet resources obtained from said corresponding origin server.

27. A method of prefetching one or more Internet resources referenced in one or more Web pages, said method comprising the steps of:

determining if one or more of said Internet resources are candidates for prefetching based on one or more estimated round trip times, wherein said one or more estimated round trip times are based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request; and

prefetching said Internet resources that are determined to be candidates for prefetching according to a descending order of said one or more estimated round trip times.

28. An article of manufacture for prefetching one or more Internet resources referenced in one or more Web pages, said article of manufacture comprising:

a computer readable medium having computer readable program code means embodied thereon, said computer readable program code means comprising program code means for causing a computer to:

obtain one or more estimated round trip times for said Internet resources, wherein said one or more estimated round trip times are based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request; and

prefetch said Internet resources based on a descending order of said one or more estimated round trip times.

29. A method of prefetching one or more Internet resources referenced in one or more Web pages, said method comprising the steps of:

obtaining one or more estimated round trip times for said Internet resources, wherein said one or more estimated round trip times are based on an interval of time between a sending of an HTTP request and a receipt of a response to said HTTP request;

identifying a subset of said Internet resources that are candidates for prefetching based on said one or more estimated round trip times; and

determining whether to prefetch one or more of said Internet resources in said subset of Internet resources based on predefined conditions, at least one of said predefined conditions being based on a descending order said one or more estimated round trip times.

#19 AF

Klemm-2

1-9-4

2700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): Reinhard Klemm
Case: 2
Serial No.: 09/164,509
Filing Date: September 30, 1998
Group: 2152
Examiner: S. Willett

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

Signature: Linda Sloat Date: December 23, 2003

Title: Method and Apparatus for Prefetching Internet Resources Based on Estimated Round Trip Time

---

TRANSMITTAL OF APPEAL BRIEF

Mail Stop Appeal Brief Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith are the following documents relating to the above-identified patent application:

(1) Appeal Brief (original and two copies); and

(2) Copy of Notice of Appeal, filed on October 27, 2003, with copy of stamped return postcard indicating receipt of Notice by PTO on October 29, 2003.

There is an additional fee of $330 due in conjunction with this submission under 37 CFR §1.17(c). Please charge **Deposit Account No. 50-0762** the amount of $330, to cover this fee. In the event of non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Deposit Account No. 50-0762** as required to correct the error. A duplicate copy of this letter and two copies of the Appeal Brief are enclosed.

Respectfully,

Kevin M. Mason

Date: December 23, 2003

Kevin M. Mason
Attorney for Applicant(s)
Reg. No. 36,597
Ryan, Mason & Lewis, LLP
1300 Post Road, Suite 205
Fairfield, CT 06824
(203) 255-6560